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Descriptions of five new species of *Homoplectra* Ross (Trichoptera, Hydropsychidae) from Japan with reassignment of *Homoplectra tohokuensis* (Kobayashi)

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Abstract

Five new species of the genus *Homoplectra* Ross 1938 (Trichoptera: Hydropsychidae) are described from Japan: *H. crassa*, *H. ise*, *H. hattorii*, *H. occidens*, and *H. gracilis*. *Diplectrona tohokuensis* Kobayashi 1973 is transferred to the genus *Homoplectra*. Geographic variations in the male genitalia are reported for four new species. Descriptions of the immature stages of *H. crassa* **sp. nov.** and *H. tohokuensis* are provided. Larvae of these species were found in small seeps and flows in hill or mountain areas.

Key words: new combination, male, female, immature stages, geographic variation, *Diplectrona*

Introduction

The genus *Homoplectra* Ross 1938, originally described from the western Nearctic region, is a small genus composed of 16 species in the Nearctic, East Palearctic and Oriental biogeographic regions (Morse 2018). Weaver (1985) reviewed this genus, and listed 11 species from USA. Ruiter (2003) described one additional species from USA. Morphology and biology of immature stages was also provided for some North American species (Weaver et al. 1979; Huryn 1989; Wiggins 1996). On the other hand, Asian species are not well known. Malicky (2015) recognized two Chinese species (one from Shaanxi (East Palearctic) and another from Sichuan (Oriental)), and Ito and Nozaki (2018) described two species from Ryukyu Islands in southwestern Japan (one each in East Palearctic and Oriental Regions). For the Asian fauna, no information is available for immatures.

Several authors have recorded adults of unnamed *Homoplectra* 'species' from the Japanese islands (e.g., Morita 2008; Ito *et al*. 2010; Katsuma 2012), but precise information has not been provided. Furthermore, *Diplectrona tohokuensis* described by Kobayashi (1973) from northern Honshu has a complicated phallic apparatus suggesting that this species may belong to *Homoplectra*. To solve these taxonomic problems, I examined specimens collected from Japanese main islands, including the holotype of *D. tohokuensis*. In this paper, I describe five new species, and transfer *D. tohokuensis* to *Homoplectra*. Descriptions of the immature stages of *H. tohokuensis* and one of the new species are also provided.

Material and methods

Association of males and females was based on similar general body characters when they were collected together. Larvae were associated by rearing or the metamorphotype method (Milne 1938). Male and female genitalia, and some characters of immature stages, were figured after being cleared in a 10% solution of KOH. Descriptions of male genitalia are based on specimens collected from the type locality (some geographic variations are reported separately). Descriptions of larvae are based on final instar specimens.

Depositories of specimens used in this study are abbreviated as follows: Natural History Museum and Institute, Chiba (CBM); personal collections of K. Inazu (KI), N. Katsuma (NoK), N. Kawase (NaK), N. Kuhara (KuN), K. Nojima (KN); M. Tanaka (MT); T. Torii (TT). Other specimens are deposited in the personal collection of the author (no indication).

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Morphological terminology for immature stages follows Weaver *et al.* (1979) and Wiggins (1996). The morphological terms (and abbreviations) of adult genitalia used in the text and figures in this work are provided in the following list.

Terminology of genitalia used in this work

Male

ae. Aedeagus: long, with dorsal longitudinal groove, divided by a flange into apical fingertip-like head and basal stem; corresponding to the process numbered (4) by Ross (1938).

d.p.a. dorsal processes of aedeagus: paired, corresponding to the processes numbered (2) by Ross (1938).

d.p.p. dorsal processes of phallotheca: paired, corresponding to the processes numbered (1) by Ross (1938).

end. endotheca: membranous.

i.a. inferior appendages: paired, one-segmented, each with apicomesal surface bearing short stout spine-like setae.

l.p.a. lateral processes of aedeagus: paired, corresponding to the processes numbered (3) by Ross (1938).

l.p.p. lateral processes of phallotheca: paired.

ph. phallotheca: sclerotized, large bulbous.

p.l. posteroventral lobe of sternum IX.

p.p. posterior processes of segment X: one or two pairs.

v.p.a. ventral process of aedeagus: divided into two lobes apically, corresponding to the process numbered (5) by Ross (1938).

Female

l.l. lateral lobes of segment VIII: paired.

v.a. vaginal apparatus: sclerotized.

v.c. vaginal chamber.

v.s. vulval scale.

Species descriptions

Homoplectra crassa sp. nov.

(Figs. 1, 7, 9)

Diplectrona sp. 3: Torii & Hattori 2006, 38.
Homoplectra sp.: Katsuma 2012, 53.
Homoplectra sp.: Tsuruda 2018, 27, 31.

Diagnosis. Males of this species and *Homoplectra ise* **sp. nov.** are unique among known *Homoplectra* species in having two pairs of posterior processes on segment X. These two males can be easily distinguished from each other by the shape of the ventral process of the aedeagus: thick in this species, but slender in *H. ise.* The female of *H. crassa* **sp. nov.** is distinguished from other Japanese species by the following characters: the posteroventral margin of segment IX is oblique, and the darkly pigmented sclerite of the vaginal chamber is visible in lateral aspect.

Adult. Head and thorax dark brown dorsally with pale setal warts. Abdomen dark brown dorsally, legs brown. Antennae yellowish brown, slightly shorter than forewings. Forewings each 7.5–8.5 mm long in male (n = 10), 8.0–10 mm long in female (n = 10); mostly dark brown with sparse pale spots. Venation as in Figures 1C, but occasionally cross vein *m-cu* close to *cu1-cu2* in forewings. Tibial spurs 2-4-4. Abdominal sternum V with pair of finger-like processes associated with scent glands near anterolateral margins, more than half as long as sternum in male, less than half as long as sternum in female; apices of these finger-like processes small globular.

Male genitalia. Sternum IX (sIX) with round anterior projection in lateral aspect; posteroventral lobe (p.l.) setose, trapezoidal in ventral aspect, with shallow median concavity. Tergum IX (t.IX) round posteriorly in dorsal aspect, fused with segment X (X) laterally. Segment X large, bilobed in dorsal aspect, membranous posteroventrally; two pairs of posterior processes (p.p.) strongly sclerotized, each apex with stout spine surrounded by hair. Inferior appendages (i.f.) without distal segment, extending beyond apex of segment X; each apex obliquely truncate in lateral and ventral aspects, with short spine-like setae mesally. Phallic apparatus thick, pair of dorsal processes of phallotheca (d.p.p.) long triangular in lateral aspect, short forceps-like in dorsal aspect, dorsomesal margin serrate;

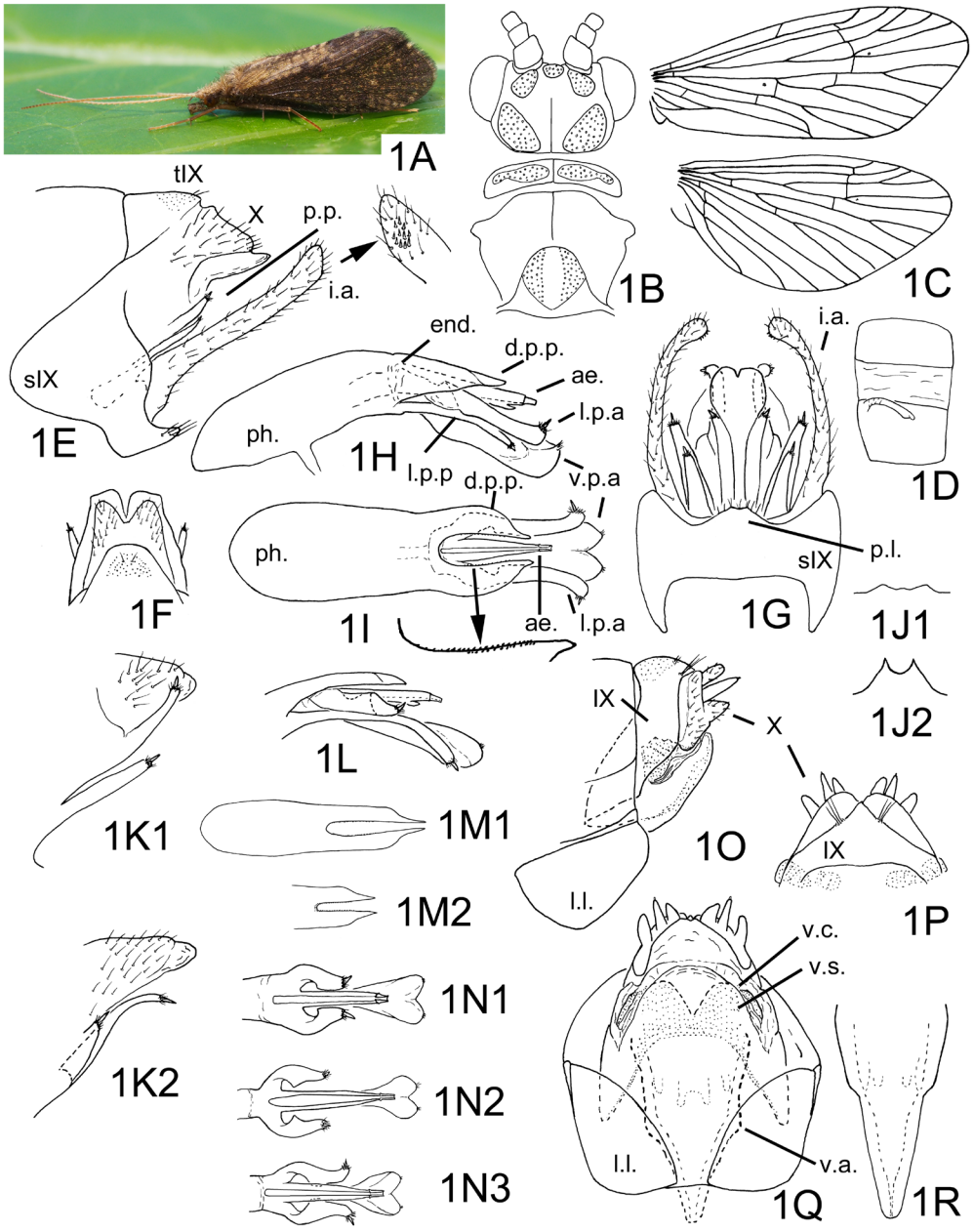


FIGURE 1. Adults of *Homoplectra crassa* sp nov. 1A, male habitus, left lateral; 1B, male head and pro- and mesonota, dorsal; 1C, male right wings, dorsal; 1D, male sternum V, left lateral. 1E–1I, male genitalia, type locality (Tokyo, Hino-shi): 1E, left lateral, apicomesal part enlarged; 1F, dorsal; 1G, ventral; 1H, phallic apparatus, left lateral; 1I, same, dorsal, mesal margin of left dorsal process of phallotheca enlarged. 1J–1N, male genitalia, variations: 1J1, ventral lobe of segment IX, ventral, Kanagawa (Yokosuka-shi); 1J2, same, Nagano (Chino-shi); 1K1, segment X, left lateral, Kanagawa (Yokosuka-shi); 1K2, same, Shizuoka (Fujieda-shi); 1L, phallic apparatus, left lateral, Shizuoka (Fujieda-shi); 1M1, phallotheca, dorsal, Shizuoka (Fujieda-shi); 1M2, dorsal process of phallotheca, dorsal, Kanagawa (Yokosuka-shi); 1N1, aedeagus, dorsal, Shizuoka (Fujieda-shi); 1N2, same, Kanagawa (Yokosuka-shi); 1N3, same, Nagano (Chino-shi). 1O–1Q, female genitalia, type locality except as indicated: 1O, left lateral; 1P, dorsal; 1Q, ventral. 1R, female vaginal sclerite, ventral, Yamanashi (Hayakawa-machi). Abbreviations: ae. = aedeagus, d.p.p. = dorsal process of phallotheca (paired), end. = endotheca, i. a. = inferior appendage (paired), IX = abdominal segment IX, l.l. = lateral lobe of sternum VIII (paired), l.p.a = lateral process of aedeagus (paired), l.p.p, = lateral process of phallotheca (paired), p.l. = posteroventral lobe of sternum IX, ph. = phallotheca, p.p. = posterior process of segment X (paired), sIX = sternum IX, tIX = tergum IX, v.a. = vaginal apparatus; v.c. = vaginal chamber, v.s. = vulval scale, v.p.a. = ventral process of aedeagus, X = abdominal segment X.

pair of lateral processes of phallotheca (l.p.p.) longer than dorsal processes of phallotheca, slightly curved downward, each having apex with single spine surrounded by hair. Aedeagus (ae.) with short head and with small ventral unpigmented bulge near head; pair of lateral processes of aedeagus (l.p.a) longer than aedeagus, twisted near base, each having apex with single spine surrounded by hair; ventral process of aedeagus (v.p.a.) thick, slightly longer than lateral processes of aedeagus, boat-shaped in lateral aspect, apex heart-shaped in dorsal aspect, with tiny setae apicodorsally.

Geographic variations in male genitalia. Males collected from Kawasaki-shi, Kanagawa Prefecture have the same genitalic characters as those collected from the type locality, but other males are variable in the shape and/or length of the posteroventral lobe of segment IX, the posterior processes of segment X, and the phallic processes (e.g., Figs. 1J–1N).

Female genitalia. Sternite VIII cleft from base, forming pair of lateral lobes (l.l.) widely separated from each other posteriorly in ventral aspect; mesal margins of lateral lobes not fused with segment VIII. Segment IX (IX) triangular in dorsal aspect, obliquely S-shaped in lateral aspect. Segment X (X) rectangular in lateral aspect; each ventrolateral margin round in lateral aspect, darkly pigmented. Vulvar scale (v.s.) large, posterior part membranous; vaginal chamber (v.c.) sclerotized posterodorsally, pair of lateral darkly pigmented sclerites visible in lateral and ventral aspects. Vaginal apparatus (v.a.) pentagonal in ventral aspect, with long triangular projection anteriorly; in females from Hayakawa-cho, Yamanashi, middle part slightly narrower in ventral aspect, with longer anterior projection (Fig. 1R).

Final instar larva. Length up to 13 mm. Head 1.6–1.8 mm wide (n = 10), approximately same length as width, dark brown; frontoclypeal apotome broadly pyriform in dorsal aspect, with rounded constrictions around eyes and broad angles posterior of eyes, anterior margin slightly concave in middle; secondary setae usually acicular (Fig. 7C), but clavate (Fig. 7D) in 7 of 20 larvae collected from type locality and all larvae collected from Sakai-gawa, Kanagawa Prefecture. Mandibles each with stout basodorsal flange laterally, with 5 teeth. Pronotum with transverse sulcus on posterior 1/4. Thoracic nota with normal setae, but larvae collected from Sakai-gawa, Kanagawa Prefecture with clavate secondary setae. Middle femora, tibiae, and tarsi, and hind femora and tibiae with pinnate setae mesoventrally. Meso- and metathorax and abdominal segments bearing gills, with one pair of ventral tufts of gills on mesothorax and abdominal segment VII, with two pairs of ventral tufts of gills on metathorax and each of abdominal segments I to VI, with 1–3 lateral conical gills on each of abdominal segments III to VII.

Pupa. Length 8–9 mm (n = 2). Mandibles slender, with 3 (right) or 4 (left) apical and subapical teeth, each mandible with stout mesal plate-like projection on apical 1/3. Middle tarsi bearing sparse hair-like setae. Abdominal segments with dorsal hook plates anteriorly on II to VIII, posteriorly on III and IV. Abdominal segments bearing gills, with one pair of ventral tufts of gills on each of abdominal segments II to VII, with 1–3 lateral conical gills on each of abdominal segments III to VII. Anal processes strongly sclerotized, bifurcated, concave ventral surfaces covered by tiny spines.

Holotype. Male (pinned): Mogusa-yama-ryokuchi, Misawa, Hino-shi, Tokyo, 35.6564°N, 139.4256°E, alt. 76 m, 16.vi.2017, T. Nozaki (CBM-ZI 0167047).

Paratypes. 3 males (pinned), same data as holotype (CBM-ZI 0167048–0167050); 4 males, 2 females (in alcohol), type locality, 3.ix.2005, D. Tsuruda (CBM-ZI 0167051–0167056).

Other specimens examined. Ibaraki: 1 male, Hatori, Sakuragawa-shi, 7.vii.2011, H. Sakurai (NoK). **Tokyo:** 2 males, 1 female, 2 larvae, 1 pupa, same data as holotype; 1 male, type locality, 3.vii.2005, D. Tsuruda; 1 larva, type locality, 10.vi.2006, D. Tsuruda; 1 male, 1 female, 17 larvae, type locality, 14.vi.2018, T. Nozaki (9 larvae: CBM); 2 males, Tama-gawa, Okutama-machi, 4.vii.1987, N. Gyotoku. **Kanagawa:** 1 larva, Ikuta-ryokuchi, Tama-ku, Kawasaki-shi, 29.vi.1986, T. Nozaki; 2 males, 1 female, 2 pupal exuviae, same collection data, pupae collected on 29.vi.1986, adults emerged on 18–28.vii.1986, by T. Nozaki; 7 larvae, Sakai-gawa, Shiroyama, Midori-ku, Sagamihara-shi, 24.iv.1984, T. Nozaki; 4 females, 4 pupal exuviae, same collection data, larvae collected on 24.iv.1984, adults emerged on 13.vi.1984–1.viii.1984; 1 pupa, same locality, 23.vii.1984, M. Tokuda; 2 males, same locality, 9–10.viii.1984, T. Nozaki; 7 larvae, same locality, 10.viii.1984, T. Nozaki; 1 female, same locality, 6.ix.1984, T. Nozaki, 1984; 1 female, Matsutake-yama, Toya, Midori-ku, Sagamihara, 24.vii.2011, T. Nozaki; 1 larva, Morito-gawa, Sakurayama, Zushi-shi, 15.iii.2009, T. Nozaki; 5 larvae, same locality, 11.v.1998, T. Nozaki; 6 larvae, Nobi, Yokosuka-shi, 7.iv.1988, T. Nozaki; 2 males, same locality, 15.vii.1989, T. Nozaki. **Yamanashi:** 1 male, 1 female, small stream, Akasawa, Hayakawa-cho, 3.viii.2008, T. Nozaki; 1 male, 3 females, seep, alt. 500 m, Akasawa, Hayakawa-cho, 23–24.viii.2009, T. Nozaki & T. Hattori. **Nagano:** 1 male, Tanasawa-gawa, alt. 980

m, Tera, Ina-shi, 21.vi.2003, T. Nozaki; 4 males, Toyohira, Chino-shi, 25.vii.2012, N. Katsuma (NoK). **Shizuoka:** 1 male, 1 larva, Utoge-no-taki, Setonoya, Fujieda-shi, 4.viii.2004 (TT); 1 male, 1 larva, Yamame-dani, Setonoya, Fujieda-shi, 1.vii.2007 (TT). **Aichi:** 2 males, Takadoya-shicchi, Otagi-cho, Toyota-shi, 27.vii.2012, H. Nishimoto.

Etymology. The specific epithet (Latin adjective, "thick") refers to the thick ventral process of the aedeagus.

Distribution. Honshu (central).

Biology. Larvae of this species were collected from seeps in hill or mountain areas. The adult flight season is June to October at the type locality (Tsuruda 2018).

Japanese name. Futoo-nisemiyama-shima-tobikera.

Remarks. Immature stages of this species and another Japanese species, *H. tohokuensis*, are similar to those of North American species described by Weaver *et al*. (1979), Huryn (1989), and Wiggins (1996). The larva of this species can be distinguished from that of *H. tohokuensis* by the shape of the anterior margin of the frontoclypeal apotome: Slightly concave in this species, but slightly convex in *H. tohokuensis*.

Homoplectra ise sp. nov.

(Figs. 2, 9)

Homoplectra sp.: Morita 2008, 92–93.
Homoplectra sp. 1.: Yamamoto & Ito 2014, 13.

Diagnosis. The male of this species is similar to that of *H. crassa* **sp. nov.** in having two pairs of posterior processes of segment X, but the male of *H. ise* **sp. nov.** is easily distinguished from *H. crassa* **sp. nov.** by the shape of the ventral process of the aedeagus: slender in *H. ise*, but thick in *H. crassa*. The female of *H. ise* **sp. nov.** can be distinguished from those of other known Japanese species by the round posteroventral projection of the segment IX.

Adult. Specimens in alcohol mostly dark brown, but antennae and legs light brown; general morphology similar to that of *H. crassa* **sp. nov.** Forewings each 7.5–9.5 mm long in male (n = 10), 8.0–9.5 mm long in female (n = 10).

Male genitalia. Sternum IX triangular in lateral aspect, with blunt anterolateral angle of 50° on each side; posteroventral lobe divided mesally by U-shaped excision into pair of acute peaks in ventral aspect. Segment X large, bilobed, with each lobe twice as long as broad in dorsal aspect; membranous posteroventrally. Two pairs of strongly sclerotized processes arising from segment X posteroventrally, apex of each process usually with single spine surrounded by hair, but rarely with two spines. Inferior appendages long, slightly bent in apical 1/3 in lateral aspect; each with apex obliquely truncate in dorsal and ventral aspects, with short spine-like setae mesally. Phallotheca with rough surface near bases of dorsal processes; pair of dorsal processes finger-like in lateral aspect, with single spine surrounded by hair, each spine directed ventrolaterad; pair of lateral processes of phallotheca long, each with apex wide in lateral aspect and with single spine surrounded by hair, directed dorsad. Aedeagus with short head and with unpigmented bilobed bulge ventrally at apical 1/3; pair of lateral processes twisted near base, apex of each with single spine surrounded by hair, directed dorsolaterad; ventral process slender, bilobed usually in apical 1/5 but rarely apical 1/4, each lobe with single spine surrounded by hair apically.

Geographic variations of male genitalia. The shape and/or length of the phallic processes are variable (Figs. 2F–2I).

Female genitalia. Sternites VIII close to each other mesally, mesal margins fused with segment VIII basally. Segment IX obliquely S-shaped in lateral aspect, with short round posteroventral projection. Segment X oval in lateral aspect. Vulvar scale large, posterior part membranous; vaginal chamber sclerotized posterodorsally. Vaginal apparatus pentagonal in ventral aspect, with triangular semimembranous projection anteriorly.

Immature stages. Unknown.

Holotype. Male (in alcohol). Iseji, Minamiise-cho, Mie, 34.3861°N, 136.6611°E, alt. 340 m, 18.vi–2.vii.2008, H. Morita, Malaise trap (CBM-ZI 0167057).

Paratypes. 10 males, 6 females, same data as holotype (CBM-ZI 0167058–0167073).

Other specimens examined. Mie: 9 males, 6 females, same data as holotype; 3 males, 3 females, Aoyama-kogen, Okubano, Iga-shi, 19.viii.2012, H. Morita, light trap; 3 females, same locality, 25.viii.2012, H. Morita; 3 males, headwater of Kiyodani-gawa, Myojin-daira, Iidakacho-aoda, Matsuzaka-shi, 18.vii.1998, H. Morita. **Ehime:** 1 male, Mt. Izugatani, Kumakogen-cho, 11–20.vii.2012, E. Yamamoto, Malaise trap; 1 male, Mt. Kasatori, Uchiko-cho, 21–25.vii.2012, E. Yamamoto, Malaise trap; 2 males, 1–10.iii.2012, E. Yamamoto, Malaise trap.

Etymology. The specific epithet refers to the traditional name of the area where the type series specimens were collected.

Distribution. Honshu (Mie), Shikoku (Ehime).

Habitat. Adults of this species were collected from a small mountain stream (50 cm wide) at the type locality by a Malaise trap (Morita 2008).

Japanese name. Ise-nisemiyama-shima-tobikera

Homoplectra hattorii sp. nov.

(Figs. 3, 9)

Homoplectra sp.: Ito *et al.* 2010, 61.

Diagnosis. The male of this species is somewhat similar to that of *Homoplectra crassicornea* Nozaki & Ito 2018 (in Ito & Nozaki 2018) in the shape of the phallic apparatus, but is easily distinguishable from the latter by the shape of the dorsal processes of the phallotheca in dorsal aspect: Acute, forceps-like, and bare in this species, but each a long straight finger-like process bearing an apical spine surrounded by hair in *H. crassicornea*.

Adult. Specimens in alcohol mostly dark brown, but antennae and legs light brown. Forewings each 6.2–7.2 mm long in male (n = 10). Venation similar to that of *H. crassa* **sp. nov.** Abdominal sternum V with pair of finger-like processes anterolaterally, each with apex blunt.

Male genitalia. Sternum IX triangular in lateral aspect, with blunt anterolateral angle of about 40° on each side; short and setose posteroventral lobe semicircular in ventral aspect. Tergum IX trapezoidal in dorsal aspect, broadly fused with segment X laterally. Segment X setose, tall, smoothly quadrate in lateral aspect, bilobed in dorsal aspect; each lobe with small spine-like posterior process, curved dorsad. Inferior appendages long, extending far beyond apex of segment X, 1-segmented, gradually broader and truncate apically, with short spine-like setae apicomesally. Phallotheca with dorsal processes (d.p.p) forceps-like in dorsal aspect, each with lateral angle in middle and acute apex; pair of lateral processes (l.p.p.) longer than dorsal processes, blade-like in lateral aspect, each with acute apex directed dorsad. Aedeagus (ae.) slender, with short fingertip-like head; pair of dorsal processes (d.p.a.) slender, arising basodorsally, directed ventrad and then posterad, acute apices with many short fine hairs; pair of short lateral processes (l.p.a) thick and sinuous, acute apices directed dorsolaterad.

Female and immature stages. unknown.

Holotype. Male (in alcohol), Toyookanisen-zawa, Pankehoronai-gawa, Toyooka, Ashibetsu-shi, **Hokkaido**, 43.6079°N, 142.1306°E, alt. 370 m, 28.vi–25.vii.2013, Y. Nagasaka & A. Nagasaka, Malaise trap (CBM-ZI 0167074).

Paratypes. 8 males (in alcohol), same data as holotype (CBM-ZI 0167075–0167082).

Other specimens examined. Hokkaido: 1 male, Nakanosawa-gawa, Pankehoronai-gawa, Toyooka, Ashibetsu-shi, alt. 465 m, 12–25.vii.2013, Y. Nagasaka & A. Nagasaka, Malaise trap; 6 males, Penkebushunai, Sorachi-gawa, Hyakkocho-kita, Akabira-shi, alt. 430 m, 28.vi.–8.viii.2013, Y. Nagasaka & A. Nagasaka, Malaise trap; 1 male, Apoi-dake, Samani-cho, 42.11°N, 143.00°E, 20.vii.2009, N. Kuhara (KuN).

Etymology. This species is dedicated to my friend, the late Mr. T. Hattori, who provided me much valuable information on Japanese caddisflies, including the genus *Homoplectra*.

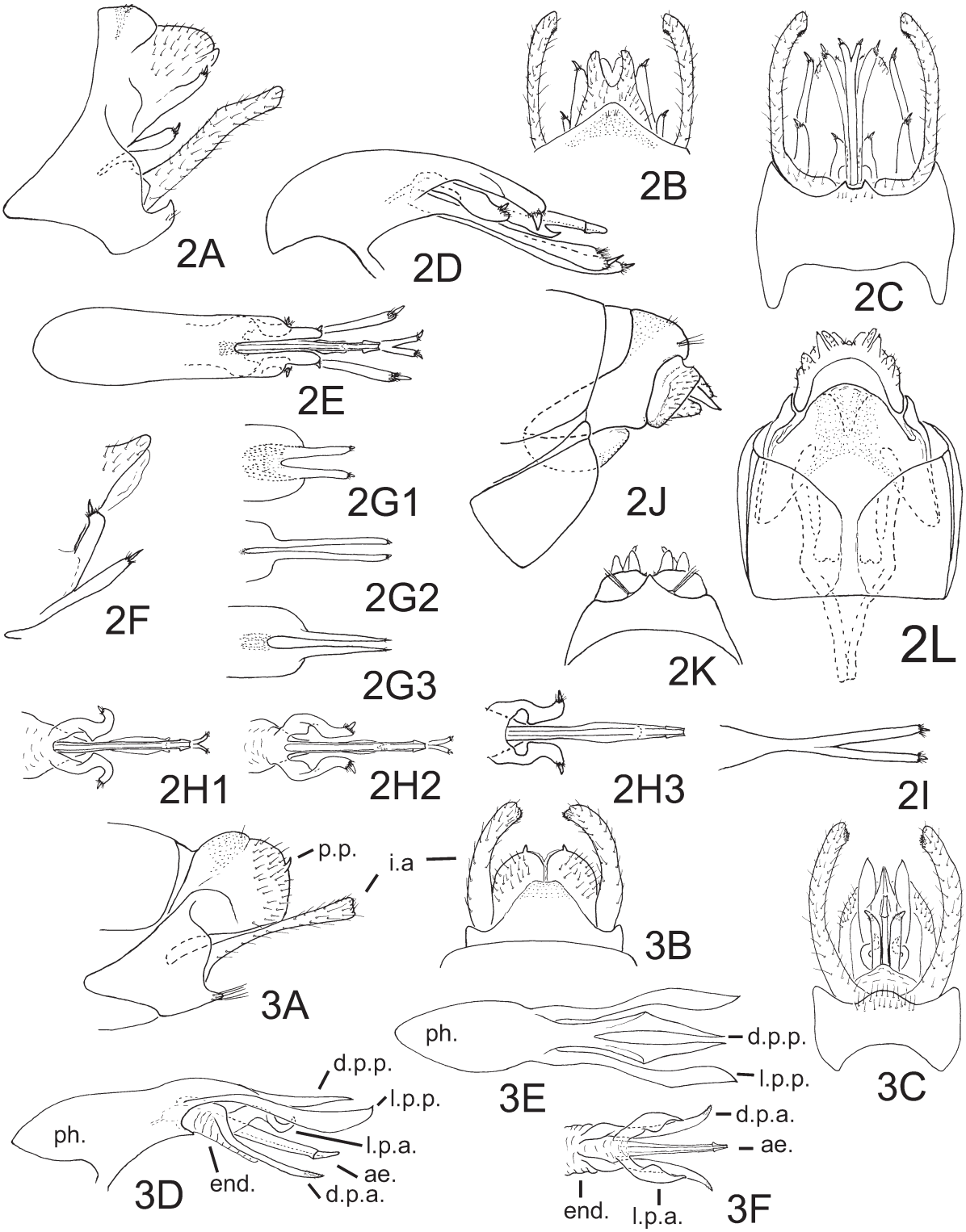
Distribution. Hokkaido (central to south).

Habitat. Adults of this species were collected with Malaise traps set across small headwaters (Nagasaka and Ito, personal communication on 1.iii.2018).

Japanese name. Hattori-nisemiyama-shima-tobikera.

Remarks. In the original description of *H. crassicornea* (Ito & Nozaki 2018), the dorsal processes of the aedeagus were interpreted as the ventral processes of the aedeagus. Although the processes of *H. crassicornea* extend along the venter of the aedeagus, they arise from the basodorsal part of the aedeagus. They must be homologous to the processes numbered (2) by Ross (1938).

Ito *et al.* (2010) recorded an unidentified male of the genus *Homoplectra* from Hokkaido. Photographs of this male were provided by the late Mr. Hattori, including the genitalic morphology. I examined them and recognized the species as *H. hattorii*.



FIGURES 2–3. 2A–2L, adults of *Homoplectra ise* sp. nov. 2A–2E, male genitalia, type locality (Mie, Minamiise-cho): 2A, left lateral; 2B, dorsal; 2C, ventral; 2D, phallic apparatus, left lateral; 2E, same, dorsal. 2F–2I, male genitalia, variations: 2F1, segment X, left lateral, Ehime (Uchiko-cho); 2G1, apical half of phallotheca, dorsal, Mie (Iga-shi); 2G2, same, Mie (Matsuzaka-shi); 2G3, same, Ehime (Uchiko-cho); 2H1, aedeagus, dorsal, Mie (Iga-shi); 2H2, same, Mie (Matsuzaka-shi); 2H3, same, Ehime (Uchiko-cho); 2I, ventral process of aedeagus, ventral, Ehime (Uchiko-cho). 2J–2L, female genitalia, type locality: 2J, left lateral; 2K, dorsal; 2L, ventral. **3A–3F, male genitalia of *Homoplectra hattorii* sp. nov.** type locality (Hokkaido, Ashibetsu-shi): 3A, left lateral; 3B, dorsal; 3C, ventral; 3D, phallic apparatus, left lateral; 3E, same, dorsal; 3F, aedeagus, dorsal. Abbreviations: ae. = aedeagus, d.p.a. = dorsal process of aedeagus (paired), d.p.p. = dorsal process of phallotheca (paired), end. = endotheca, i. a. = inferior appendage (paired), l.p.a = lateral process of aedeagus (paired), l.p.p, = lateral process of phallotheca (paired), ph. = phallotheca, p.p. = posterior process of segment X (paired).

***Homoplectra tohokuensis* (Kobayashi 1973)**
(Figs. 4, 8, 9)

Diplectrona tohokuensis Kobayashi 1973, 31–32, pl. 7, male. **New combination**.

Diagnosis. The male and female of this species are somewhat similar to those of *H. occidens* **sp. nov.**, but can be distinguished by the characters given in the diagnosis for that species, below.

Adult. Mostly dark brown, but femora, tibiae and tarsi of all legs light brown. Forewings each 6.2–8.4 mm long in male (n = 8), 7.5–9.5 mm in female (n = 3). Venation similar to that of *H. crassa* **sp. nov.** Abdominal sternum V with pair of finger-like processes, more than half as long as sternum in male, approximately half length of sternum in female, each with apex narrowed.

Male genitalia. Sternum IX protruding anteriorly, with round apex on each side in lateral aspect; short posteroventral lobe semicircular in ventral aspect, but often trapezoidal. Tergum IX broadly fused with segment X. Segment X large, bilobed in dorsal aspect, unpigmented dorsomesally, setose laterally, membranous posteroventrally; each lobe with acute posterior process curved dorsad. Inferior appendages long, 1-segmented, each with apical 1/4 slightly curved upward, apex blunt with short spine-like setae ventromesally. Phallic apparatus arcuate in lateral aspect, phallotheca with pair of slender, straight, acute dorsal processes; with pair of lateral, acute processes slightly shorter than dorsal processes, curved slightly ventrad apically. Aedeagus slender, fingertip-like head long, approximately 1/3 as long as basal stem, apex curved slightly upward; pair of fin-like lateral processes fused with aedeagus in their basal 2/3; needle-like process arising from base of each fin-like process, each with apex extending slightly beyond apex of its lateral fin-like process.

Female genitalia. Lateral lobes of sternite VIII fused with segment VIII about 1/3 distance from base, smoothly triangular in ventral aspect. Segment IX obliquely S-shaped in lateral aspect, mucronate posteromesally in dorsal aspect. Vulval scale large, with round semimembranous apex in ventral aspect. Vaginal apparatus long oval in ventral aspect, anterior finger-like part protruding into segment VII.

Larva. Length up to 12 mm. Head 1.6 mm wide (n = 3). Very similar to *H. crassa*, but anterior margin of frontoclypeal apotome slightly convex.

Pupa. Only one set of pupal exuviae available for this study. Indistinguishable from *H. crassa* **sp. nov.**

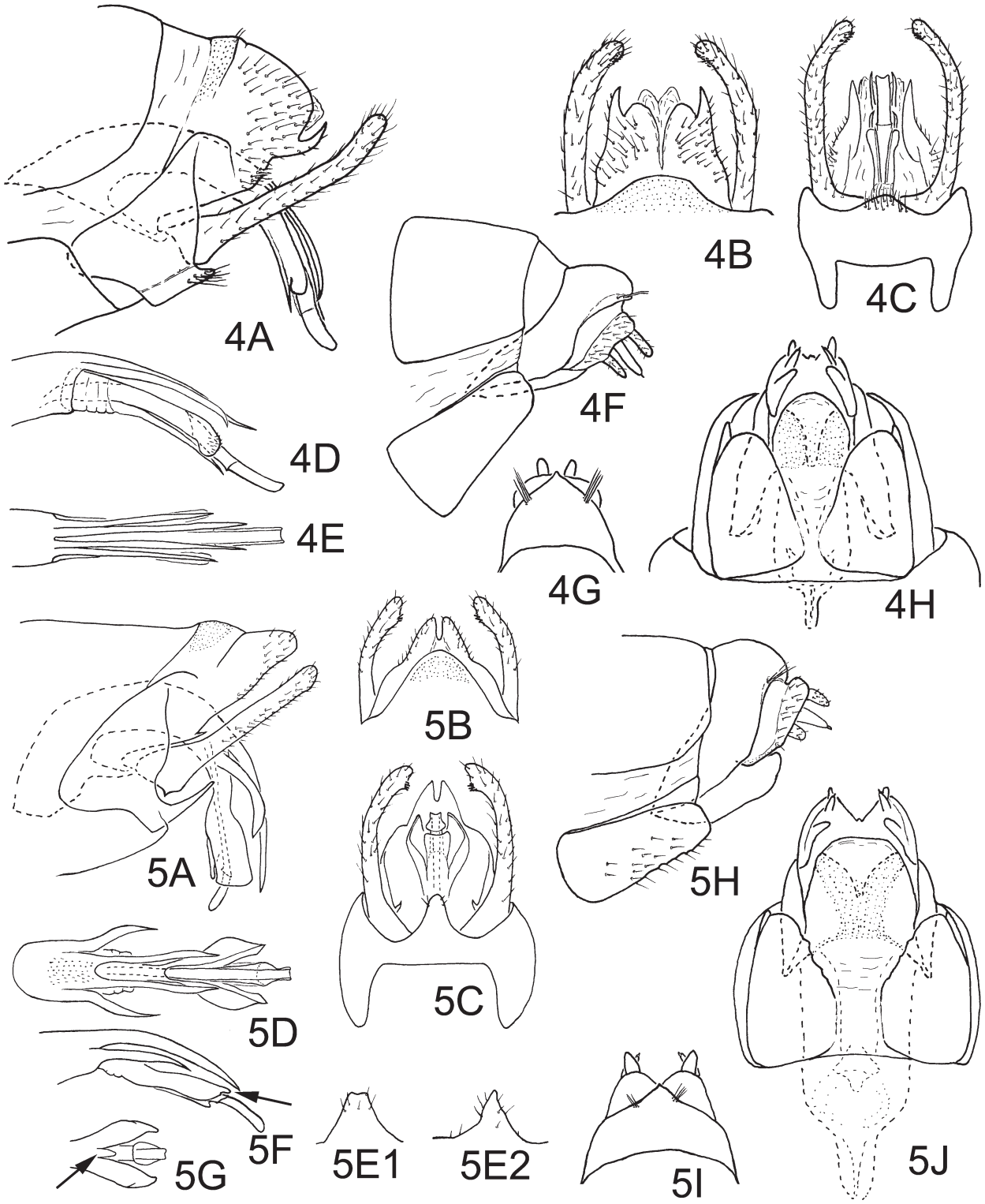
Specimens examined. Holotype, male, Minoyama, Hirata-machi, Akumi-gun, Yamagata, 21.v.1970, K. Shirahata (CBM: M2565). **HONSHU. Aomori:** 2 males, 1 female, brooklet, Sasanai-gawa, Iwasaki, Fukaura-machi, 17.vii.2004, N. Kuhara. **Iwate:** 2 males, Hiraniwa-kogen, Yamagata-cho, Kuji-shi, 12.vii.1997, N. Kuhara (KuN); 1 male, Kassenba, Yamagata-cho, Kuji-shi, 19.vii.2004, N. Kuhara (KuN); 6 males, brooklet beside Iwaigawa, alt.178 m, Kuji-shi, 12.vi.2004, N. Kuhara (KuN); 2 males, head of Mitakai-gawa, alt. 750 m, Iwaizumi-cho, 19.vii.2004, N. Kuhara (KuN); 1 male, brooklet nr. Hayasaka-toge, alt. 820 m, Iwaizumi-cho, 18.vii.2004, N. Kuhara (KuN); 1 male, Mitaki, Koromogawaku-nagafukuro, Oshu-shi, 19.iv.2017, T. Ito; 1 male, Misawa-gawa, Koromogawaku-omori, Oshu-shi, 19–20.vi.2017, T. Ito; 1 male, 1 female, Yagosawa, Oshu-shi, 14.vii.2012, M. Tanaka. **Miyagi**: 8 males, 2 females, Onamezawa, Natori-gawa, Sendai-shi, 1.vi.1994, T. Ito; 3 males, Futakuchi, Sendai-shi, 10.v.1997, T. Ito (KuN). **Akita:** 1 male, Ainono, Sannai, Yokote-shi, 18.vi.2011, M. Tanaka (MT); 1 male, Kubo, Sannai, Yokote-shi, 18.vi.2011, M. Tanaka (MT); 1 male, Takinoshita, Masuda, Yokote-shi, 15.vi.2011, M. Tanaka (MT); 1 male, Mt. Mitake, Yokote, Yokote-shi, 1.viii.2011, M. Tanaka (MT); 1 male, Yubichi-zawa, Tazawa-ko, Senboku-shi, 24.ix.2013, M. Tanaka (MT); 1 male, Mt. Ohikage, Oodate, Oodate-shi, 15.vi.2008, M. Tanaka; 1 male, Kitanomata-zawa, Higashinaruse-mura, 10.ix.2013, M. Tanaka; 1 male, Kotaki-zawa, Nakasen, Daisen-shi, 13.vii.2008, M. Tanaka; 1 male, 1 female, Nibetsu, Akita-shi, 24.v.2017; M. Tanaka. **Yamagata:** 1 larva, 2 prepupae, seep, near headwater of Ara-kawa River, Oguni-machi, 1.vi.1986, T. Nozaki; 1 male, same locality., pupa collected on 1.vi.1986, adult emerged on 16.vi.1986 by T. Nozaki; 2 males, 1 female, Ooisawa, Nishikawa-machi, 24.v.1998, T. Nozaki; 1 male, same data except collector A. Ohkawa (TT); 4 males, Hirano, Nagai-shi, 6.vi.2013, N. Katsuma (NoK).

Etymology. This species was named from the Tohoku district, northeastern Honshu.

Distribution. Honshu (northeast).

Habitat. Larvae of this species were collected from a seep where water flows through cracks of vertical rock faces in a mountain area.

Japanese name. Tohoku-miyama-shima-tobikera



FIGURES 4–5. Adults of *Homoplectra* spp. 4A–4H, *Homoplectra tohokuensis* (Kobayashi 1973). 4A–4E, male genitalia: 4A, left lateral; 4B, dorsal; 4C, ventral; 4D, apical half of phallic apparatus, left lateral; 4E, same, dorsal. 4F–4H, female genitalia: 4F, left lateral, 4G, dorsal; 4H, ventral. **5A–5J, *Homoplectra occidens* sp. nov.** 5A–5D, male genitalia, type locality: 5A, left lateral; 5B, dorsal; 5C, ventral; 5D, phallic apparatus, dorsal. 5E–5G, male genitalia, variations: 5E1, posteroventral lobe of abdominal segment IX, ventral, Shiga (Takashima-shi); 5E2, same, Okayama (Tsuyama-shi); 5F, apical half of phallic apparatus, left lateral, Shiga (Takashima-shi); 5G, apical part of aedeagus, ventral, Shiga (Takashima-shi). 5H–5J, female genitalia, type locality: 5H, left lateral; 5I, dorsal; 5J, ventral. Arrows see text.

Remarks. Kobayashi (1973) described this species as a member of the genus *Diplectrona* Westwood 1839 (1838–1840). I examined the holotype male of this species deposited in CBM, and confirmed the general morphology. The short and wide postcostal cell of the forewing venation, the pair of finger-like processes of abdominal sternum V, and one-segmented inferior appendages are in common with *Homoplectra* species.

Homoplectra occidens sp. nov.

(Figs. 5, 9)

Homoplectra sp.: Kawase *et al*. 2017, 32.
Homoplectra sp. B: Nojima 2017 119.

Diagnosis. The male of this species is somewhat similar to that of *H. tohokuensis* in the shape of the phallic apparatus, but it is easily distinguishable by the position of the posterior processes of segment X: The process arising from near the base in *H. occidens* **sp. nov.**, but from nearer the dorsum in *H. tohokuensis*. The female of *H. occidens* **sp. nov.** is also similar to that of *H. tohokuensis* in the shape of segments VIII to X, but it is distinguishable from the latter by the size of the vaginal apparatus: The vaginal apparatus of this species is longer than that of *H. tohokuensis*, largely filling segment VII.

Adult. Body and forewings mostly dark brown in alcohol. Forewings each 5.7–7.0 mm long in male (n = 8), 5.5–8.0 mm long in female (n = 7). Venation similar to that of *H. crassa* **sp. nov.** Anterolateral processes of segment V with blunt apices, more than half as long as male sternum, less than half as long as female sternum.

Male genitalia. Sternum IX smoothly triangular in lateral aspect, with round anteolateral lobe on each side; posteroventral lobe large, triangular with blunt apex in ventral aspect. Tergum IX semicircular in dorsal aspect, broadly fused with segment X laterally. Segment X protruding posterodorsally; bilobed in dorsal aspect, each lobe with small acute posterior process near base. Inferior appendages long, without distal segment, each with ventromesal apex slightly bulging subapically and with short spine-like setae. Phallic apparatus strongly arcuate in lateral aspect, phallotheca with pair of dorsal processes slender, each with acute apex curved slightly ventrad; with pair of lateral processes, shorter than dorsal processes, each with acute apex, curved slightly ventrad apically. Aedeagus slender, with fingertip-like apex long, approximately 1/3 as long as basal stem, curved slightly downward; pair of broad lateral processes with basal 2/3 fused with aedeagus, each with apex concave subapicomesally, truncate in lateral aspect; plate-like process arising subapicoventrally on aedeagus, unpigmented.

Geographic variations in male genitalia. In males collected from Shiga Prefecture, the posteroventral lobe of sternum IX is trapezoidal in ventral aspect (Fig. 5E1), the lateral processes of the phallotheca are mostly straight (Fig. 5F), each lateral process of the aedeagus has an oblique apex in lateral aspect with a dorsal finger-like projection (marked with an arrow in Fig. 5F), the aedeagus is without a plate-like ventral process but a small round process occurs ventrally (marked with an arrow in Fig. 5G). In males collected from Okayama Prefecture, the posteroventral lobe of sternum IX is triangular with an acute apex (Fig. 5E2).

Female genitalia. Lateral lobes of sternum VIII triangular in ventral aspect, subapicomesal margins slightly jagged, basal 1/3 fused with segment VIII. Segment IX oblique, mucronate posteriorly in dorsal aspect, anteroventral projections blade-shaped in lateral aspect. Vulval scale large, posterior margin membranous. Vaginal apparatus round rectangular in ventral aspect, but with suddenly narrower anterior 1/3 protruding into segment VII.

Immature stages. Unknown.

Holotype. Male (in alcohol). Unawa, Yabu-shi, Hyogo, 35.3447°N, 134.5369°E, alt. 908 m, 11.vii.2004, K. Inazu (CBM-ZI 0167083.

Paratype. 1 male, 2 females, same data as holotype except collection date 6.vii.2003 (CBM-ZI 0167084–0167086); 1 male, Unawa, Yabu-shi, Hyogo, 35.3394°N, 134.5456°E, alt. 873 m, 2.vi.2009, K. Inazu (CBM-ZI 0167087); 1 female, same locality, 1.vii.2007, K. Inazu.

Other specimens examined. Shiga: 2 males, Shiratani-rindo, Makino-cho-shiratani, Takashima-shi, 17.v.2014, S. Takeda (NaK). **Hyogo:** 1 male, 2 females, same data as holotype except collection date 1.vii.2007 (KI). **Okayama:** 2 males, 2 females, Aba, Tsuyama-shi, 13.v.2016, K. Nojima (KN).

Etymology. The specific epithet (Latin, masculine noun in apposition, "west") refers to the fact that this species was found in western Honshu, whereas a related species *H. tohokuensis* was collected from northeastern Honshu.

Distribution. Honshu (central to western).

Habitat. Adults of this species were collected by net sweeping near small waterfalls or seepages on a vertical rock surface at the type locality (Inazu personal communication 5.v.2018).

Japanese name. Nishi-nisemiyama-shima-tobikera

Homoplectra gracilis sp. nov.

(Figs. 6, 9)

Diplectroninae gen. sp.: Kugo & Nozaki 1991, 7; Nozaki & Nakamura 2002, 171.
Diplectroninae gen. sp. 1: Inazu 2008, 76; Inazu 2012, 8.
Homoplectra sp. A: Nojima 2017, 119.

Diagnosis. The male of this species is easily distinguishable from other congeneric Japanese species by the narrow apices of the inferior appendages. The female is distinguishable from those of known Japanese species by the ovoid concavity on the vulval scale.

Adult. General appearance in alcohol similar to that of *H. crassa*. Forewings each 9.5–12 mm long in male (n = 10), 10.5–12.5 mm long in female (n = 8).

Male genitalia. Sternum IX triangular in lateral aspect, with large triangular posteroventral lobe in ventral aspect. Tergum IX round posteriorly in dorsal aspect, broadly fused with segment X laterally. Segment X weakly sclerotized dorsally, bilobed in dorsal aspect, with pair of membranous bulges posteroventrally, each lobe with stout posterior process arising from posteroventral margin and parallel with margin. Inferior appendages with spine-like setae along apical 1/5–1/7 ventromesally, each with tapered apex in lateral aspect, ventromesal apex very slightly bulging subapically and with short spine-like setae. Phallotheca large with posterodorsal processes forceps-like in dorsal aspect, with round shoulders at midlength; pair of lateral processes of phallotheca long, slender, gradually curved ventrad, each with single apical spine surrounded by hair. Aedeagus with short head; pair of dorsolateral processes long, each with apex directed dorsad and having single stout spine surrounded by hair; ventral process divided into two lobes at 2/3–3/4 distance from base, each with single spine and hair apicodorsally, directed posterodorsad.

Geographic variations in male genitalia. Males collected from Hiruzen-shitao, Maniwa-shi, Okayama Prefecture have the same genitalic characters as those collected from the type locality, but other males are variable in the shape of segment X (Fig. 6F) and the shape and/or length of the phallic processes (e.g., Figs. 6G–6I).

Female. Segment IX oblique in lateral aspect, mucronate posteriorly in dorsal aspect, anteroventral projections blade-shaped in lateral aspect. Segment X forming oblique parallelogram. Vulval scale large, with central ovoid concavity. Vaginal apparatus rectangular in ventral aspect, but with suddenly narrower anterior 1/4 protruding into segment VII.

Immature stages. unknown.

Holotype. Male (in alcohol). Okuyoshihara, Akaiwa-shi, Okayama, 34.7799°N, 134.1420°E, alt. 78 m, 20.v.2018, K. Nojima (CBM-ZI 0167088).

Paratypes. 2 males, same data as holotype (CBM-ZI 0167089–0167090); 1 male, 1 female, Yamanori-yama, Hiruzen-shitao, Maniwa-shi, 35.2316°N, 133.8093°E, 16.vii.2016, K. Nojima (CBM-ZI 0167091–0167092).

Other specimens examined. Hyogo: 1 female, Omenno-taki, Shinonsen-cho, 12.viii.1989, K. Kugo; 1 female, Ougino-sen, alt. 900 m, Shinonsen-cho, 11.vii.2004, K. Inazu; 1 male, Okubo, Sekinomiya, Yabu-shi, 19.viii.2017, K. Inazu (KI); 1 female, Bekku, Sekinomiya, Yabu-shi, 11.ix.2011, K. Inazu (KI) ; 1 male, 1 female, Hachibuse-kogen, Sekinomiya, Yabu-shi, 20.vii.2010, K. Inazu; 1 male, Choshiga-tani, Muraoka-ku, Kami-cho, 7.vii.2004, K. Inazu (KI); 1 female, same locality, 2.vii.2006, K. Inazu (KI). **Okayama:** 1 male, Hiruzen-kamifukuda, Maniwa-shi, 12.vii.2003, M. Takai; 1 male, Yamanori-yama, Hiruzen-shitao, Maniwa-shi, 35.2316°N, 133.8093°E, 16.vii.2016, K. Nojima, (KN); 1 male, 1 female, Hade-nishidani, Kagamino-cho, 22.vii.2012, K. Nojima (KN); 1 male, Oogaya, Nishiawakura-son, 24.vii.2016, K. Nojima (KN); 1 male, Mabicho-yata, Kurashiki-shi, 25.vi.2012, K. Nojima (KN); 1 male, Kitagishima-cho, Kasaoka-shi, 12.v.2018, K. Nojima (KN). **Hiroshima:** 1 female, Yasaka-dam, Kuritake-cho, Otake-shi, 28.vii.2000, S. Nakamura; 1 female, Hosomi-dani, Yoshiwa, Hatsukaichi-shi, 17.vii. –13.ix.2005, I. Mori.

Etymology. The specific epithet (Latin adjective, "slender") refers to the slender apex of each inferior appendage.

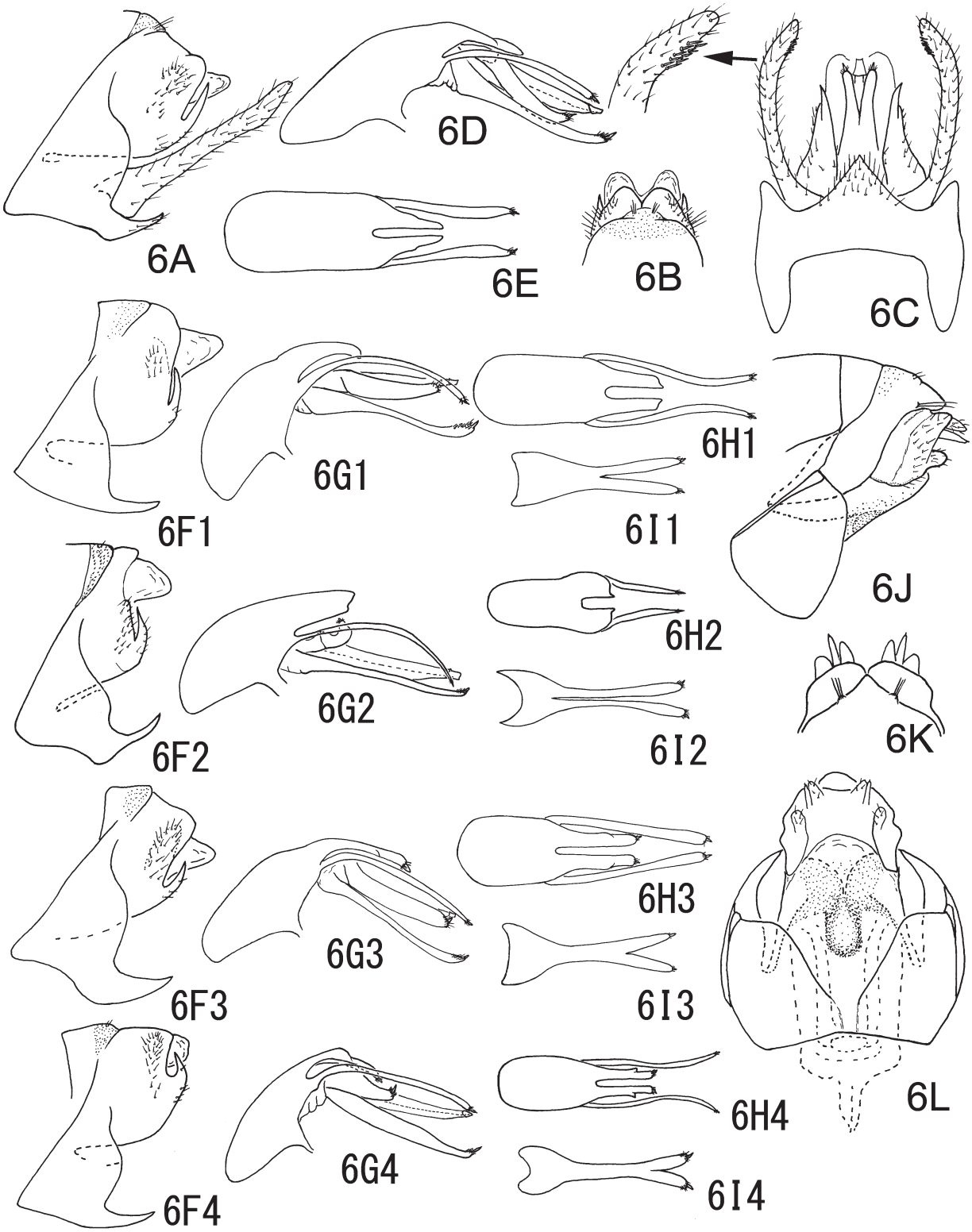
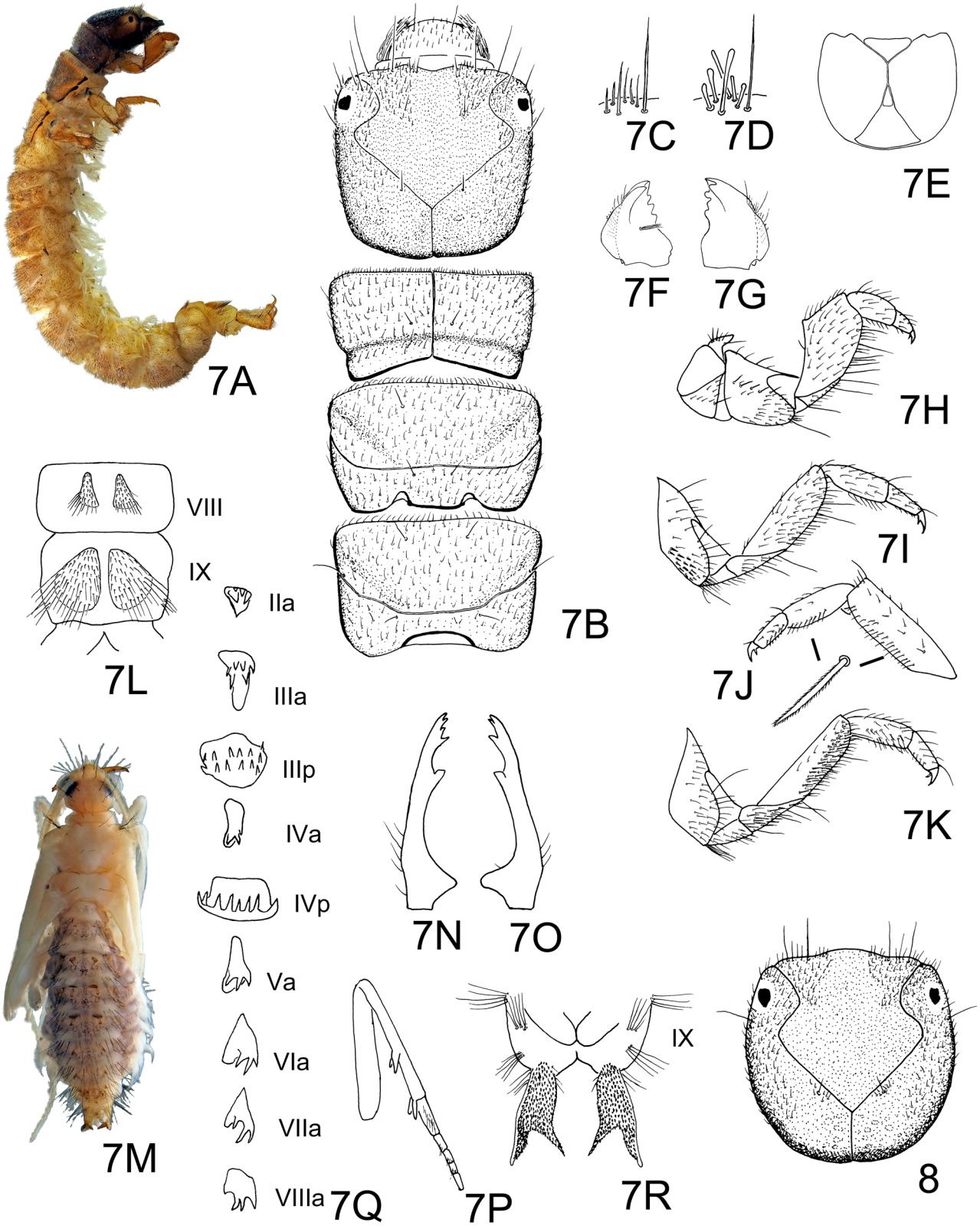


FIGURE 6. Adults of *Homoplectra gracilis* sp. nov. 6A–6E male genitalia, type locality (Okayama, Akaiwa-shi): 6A, left lateral; 6B, dorsal, 6C, ventral, apex of right inferior appendage enlarged; 6D, phallic apparatus, left lateral; 6E, phallotheca, dorsal. 6F–6I, male genitalia, variations: 6F1, segments IX and X, left lateral, Okayama (Kagamino-cho); 6F2, same, Hyogo (Yabu-shi); 6F3, same, Okayama (Kurashiki-shi); 6F4, same, Okayama (Hiruzen-kamifukuda); 6G1, phallic apparatus, left lateral, Okayama (Kagamino-cho); 6G2, same, Hyogo (Yabu-shi); 6G3, same, Okayama (Kurashiki-shi); 6G4, same, Okayama (Hiruzen-kamifukuda); 6H1, phallotheca, dorsal, Okayama (Kagamino-cho); 6H2, same, Hyogo (Yabu-shi); 6H3, same, Okayama (Kurashiki-shi); 6H4, same, Okayama (Hiruzen-kamifukuda); 6I1, ventral process of aedeagus, ventral, Okayama (Kagamino-cho); 6I2, same, Hyogo (Yabu-shi); 6I3, same, Okayama (Kurashiki-shi); 6I4, same, Okayama (Hiruzen-kamifukuda). 6J–6L, female genitalia, Okayama (Hiruzen-shitao): 6J, left lateral; 6K, dorsal; 6L, ventral.



FIGURES 7–8. Immature stages of *Homoplectra* spp. 7A–7R, *Homoplectra crassa* sp. nov. 7A–7L, larva: 7A, right lateral; 7B, head, pro-, meso-, and metanota, dorsal; 7C and 7D, setae on anterior margin of head, dorsal; 7E, head, ventral; 7F, left mandible, dorsal; 7G, right mandible, dorsal; 7H, right foreleg, posterior; 7I, right midleg, posterior; 7J, right midleg, anterior, seta near ventral margin enlarged; 7K, right hind leg, posterior; 7L, abdominal segments VIII and IX, ventral. 7M–7R, pupa: 7M, dorsal; 7N, left mandible, dorsal; 7O, right mandible, dorsal; 7P, right midleg, posterior; 7Q, dorsal hook plates, dorsal; 7R, segment IX and anal processes, ventral. **8, *Homoplectra tohokuensis* (Kobayashi 1973)**, larval head, dorsal. Abbreviations: a = anterior; p = posterior; II–IX = abdominal segments II–IX.

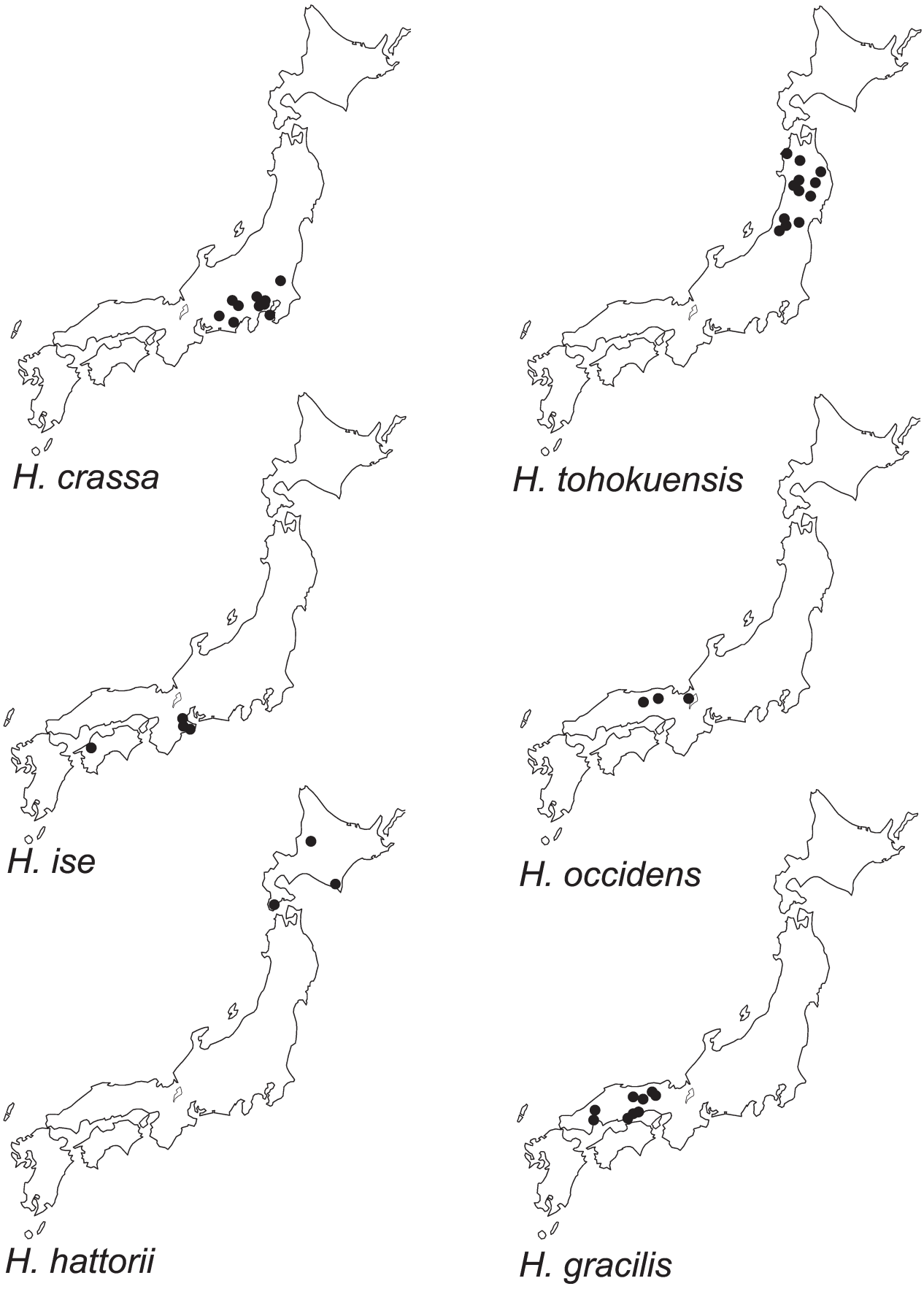


FIGURE 9. Distributions of *Homoplectra* species in Japanese main islands.

Distribution. Honshu (west).

Habitat. At the type locality, a small stream (2–3 m width) gently flowing in a forest (Nojima personal communication on 31.v.2018).

Japanese name. Hosoo-nisemiyama-shima-tobikera

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